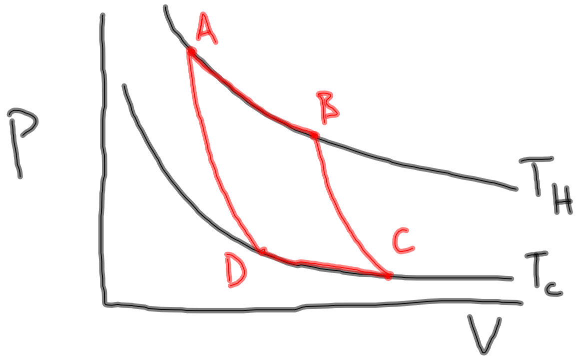
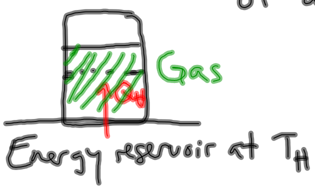
Carnot, Second Law, and Entropy Notes 4.19.12 AP Physics

Ideal, reversible cycle: Carnot cycle

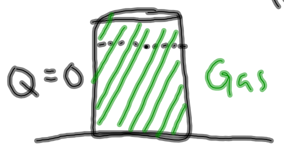
100% efficient



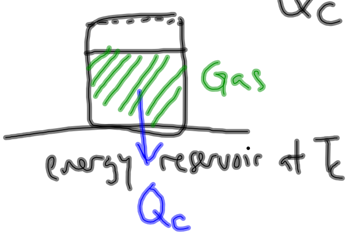
$A \to B$ isothermal expansion of a gas



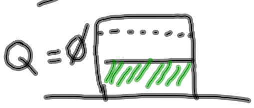
$B \to C$ adiabatic expansion (no heat coming into system)



$C \to D$ isothermal compression Q_C (heat leaving)



$D \to A$ adiabatic compression



Thermal efficiency of Carnot cycle:

$$e = 1 - \frac{|Q_C|}{|Q_H|}$$

it can be shown that

$$\frac{|Q_c|}{|Q_H|} = \frac{T_c}{T_H}$$

$$\boxed{e = 1 - \frac{T_c}{T_H}}$$

2nd Law of Thermo.:

- Kelvin-Planck

  It is impossible to construct a heat engine that, operating in a cycle, produces no effect other than the input of energy by heat from a reservoir and the performance of an equal amount of work.

- Clausius

  It is impossible to construct a cyclical machine whose sole effect is to transfer energy continuously by heat from one object to another object at a higher temperature without the input of energy by work.

- Entropy → measure of the disorder of the universe

$$\Delta S = \frac{\Delta Q}{T}$$

- This can only remain constant (reversible process) or increase (irreversible process).